FISHERY RESEARCH

Annual Performance Report April 1, 1995 to March 31, 1996

Grant Number F-73-R-18

PROJECT 3. WILD TROUT INVESTIGATIONS
Subproject 1. Whirling Disease Studies
Subproject 2. Evaluations of Salmonid Restricted Harvest Regulations Permitting the Use of Bait

PROJECT 6. BULL TROUT INVESTIGATIONS
Subproject 1. Rapid River Bull Trout Movement and Mortality Studies

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ANNUAL PERFORMANCE REPORT

State of: Idaho Grant: F-73-R-18, Fishery Research
Project No.: 3 Title: Wild Trout Investigations

Subproject No.: 1. Whirling Disease Studies

Period covered: April 1. 1995 to March 31. 1996

ABSTRACT

The fish parasite considered the causative agent in whirling disease, *Myxobolus cerebra/is (MC),* was detected in Idaho in 1985. It has been found in one private and three state fish hatcheries since 1985. Since 1993, MC has been implicated in the decline of salmonid populations in Colorado and Montana. In this first year of a three-year study evaluating the potential impacts of MC on Idaho trout and salmon, Idaho Department of Fish and Game personnel conducted statewide sampling to determine the distribution of the parasite.

Sampling indicates MC is widespread in Idaho. MC was found in the following drainages: Coeur d'Alene, Little Salmon, Upper Salmon (including the Lemhi River, Pahsimeroi River, Yankee Fork, and Salmon River upstream of the Lemhi River), Boise, Big Wood, Big Lost, Little Lost, South Fork Snake, and Teton rivers. The distribution of the parasite corresponds closely to records of known or suspected releases of live fish from state and private fish hatcheries which tested positive for the parasite. Population data will be collected in positive drainages during the following two years to examine possible impacts of the parasite on wild trout in Idaho.

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INTRODUCTION

Myxobolus cerebra/is (MC), the causative agent of whirling disease in salmonids (Markiw 1992), was first introduced to the United States from Europe during the late 1950s on the east coast. Introductions to the west coast probably occurred in California during the early 1960s. MC was first discovered in the intermountain states during 1985-1987. A conference of fish pathologists was held in Denver during 1988 to determine the potential impacts on wild populations and provide management direction to govern future distribution of fish populations which test positive for the pathogen. The conference participants concluded the pathogen was manageable within fish hatchery environments and no available data implicated the parasite in direct losses of wild salmonid populations. MC was down-listed to the Notifiable Pathogen category which requires inspection, but does not demand depopulation and disinfection of positive fish populations (Anonymous 1988). Conclusions were to not release infected fish into uninfected waters, but they could be released in waters where the pathogen already exists.

MC was first implicated in large-scale losses of rainbow trout *Oncorhynchus mykiss* in Colorado beginning with the 1993 year class in the Colorado River (Nehring and Thompson 1996, Walker and Nehring 1995). Subsequent work in Montana strongly suggests that the 1991 or 1992 year classes of rainbow trout in the Madison River have also been affected by whirling disease (Vincent 1996). MC may have caused population declines in brown trout *Sa/mo trutta* in Utah (Ron Goede, Utah Division of Wildlife Resources, personal communication) and in Colorado (Walker and Nehring 1995)

Apparent population losses in Colorado and Montana have raised concerns about similar impacts in Idaho. The presence of MC in Idaho was first confirmed in 1985. Prior to this study, known distribution within Idaho included one state and one private resident rainbow trout hatchery and two state anadromous fish hatcheries. Drainages below these hatcheries, and waters which received outplants from them, are likely positive for MC, but testing of wild salmonid populations prior to 1995 was limited in scope. Before we can assess the potential impacts of MC in Idaho, a greater knowledge of the distribution of the parasite is required. This study inventoried a cross-section of Idaho waters to determine the current distribution of MC in salmonid populations. This is the initial step in a three-year investigation to determine the impact of MC to naturally-producing salmonid populations in Idaho.

OBJECTIVES

Research Goal: Evaluate the effects of whirling disease on naturally-producing salmonid populations in Idaho.

1. To determine the distribution of MC in naturally-reproducing salmonid populations in Idaho.

METHODS

Parasite Distribution

Fish Sampling

Idaho Department of Fish and Game (IDFG) research and management personnel collected samples of trout and chinook salmon *Oncorhynchus tshawytscha* from drainages in Idaho which were suspected to be positive for MC, based on past testing or potential releases of positive fish. Samples of 60 fish each per species present in a drainage were collected and stored on ice in the field. This sample size provides 95% confidence in detecting the spore when it is present (Markiw and Wolf 1974a). Fish with external clinical signs of whirling disease (black tail, whirling behavior, spinal deformities, deformed head features) were all collected, regardless of sample size, for analysis without regard to sample size. In order to collect fish with mature parasite spores, age 1 and older individuals were selected for spring-spawning species. For fall-spawning species, we included age 0 fish in the samples if they were at least four to five months old (Markiw and Wolf 1974b).

The entire head was collected for fish <200 mm (8 in). For larger fish, a wedge was collected from the head, posterior to the eyes and anterior to the first vertebrae. Samples were transported to IDFG's Eagle Fish Health Laboratory for analysis. Samples from individual fish were split in half and stored frozen in five fish pools to await analysis.

Lab Analysis

The pepsin-trypsin-digestion (PTD) method (Markiw and Wolf 1974b) was used to test for the presence of spores in the five fish pools sequentially until all 12 pools had been examined. If no spores were detected, the sample was listed negative for MC. When a pool yielded spores of the corresponding size and shape of MC, histological examination of cranial tissue from the split samples was conducted. Histological sections were stained and examined for evidence of spores in cartilaginous tissues characteristically infected by MC spores. If spores were detected in PTD analysis but not found histologically, the sample was listed as presumptive r MC. If histological examination verified PTD results, the sample was listed as positive for MC.

RESULTS

Parasite Distribution

A total of 166 samples were collected from across Idaho for analysis of the presence/absence of MC (Appendix A). The parasite distribution is widespread (Figure 1). Drainages having one or more fish species infected with MC included: Coeur d'Alene River,

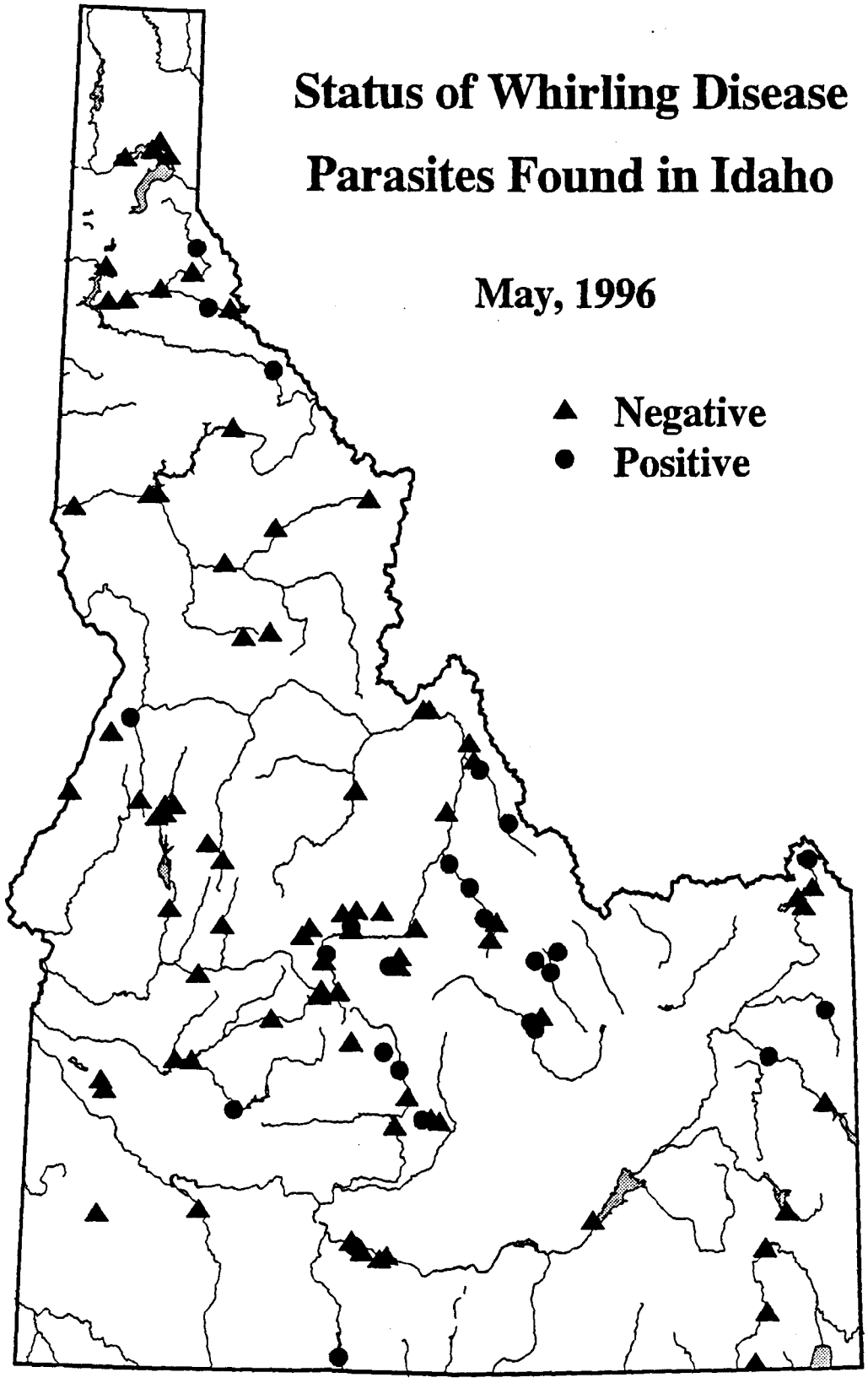

Figure 1. Distribution of *Myxobolus cerebralis* in fish sampled in Idaho during 1995.

Rapid River, upper Salmon River and major tributaries (Lemhi, Pahsimeroi, East Fork, Yankee Fork rivers), South Fork Boise River (below Anderson Ranch Dam), Wood River, Silver Creek, Big Lost River, Little Lost River, South Fork Snake River, and the Teton River. Drainages where the parasite was not found in our samples included: Pend Oreille River, Clearwater River, South and Middle Forks of the Salmon River, Payette River, Middle Fork Boise River, Middle Snake River, Bear River, Blackfoot River, and the upper Henrys Fork of the Snake River. Of the drainages testing negative, several were presumptive with spores present in PTD digest but not found in histological examination. The South Fork Clearwater River and Henrys Lake had multiple presumptive samples. A presumptive sample was also collected in Salmon Falls Creek.

We found MC spores primarily in rainbow trout populations. However, we also found infected westslope cutthroat trout *O. clarki lewisi* in the St. Joe River and Yellowstone cutthroat trout O. c. *bouvieri* in the Teton River. We also found positive populations of brook trout *Salvelinus fontinalis* in the Salmon River and South Fork Coeur d'Alene River. Although not reported elsewhere in the literature, we found positive populations of mountain whitefish *Prosopium williamsoni* throughout Idaho including: the Coeur d'Alene, upper Salmon, South Fork Boise, Big Wood, Teton, and South Fork Snake rivers. The only bull trout S. *confluentus* sample collected was from Rapid River. This sample tested negative but only included nine fish.

DISCUSSION

In Idaho, two resident rainbow trout and two anadromous salmon/steelhead hatcheries tested positive for MC during the period between 1985 and 1987. The resident fish hatcheries which tested positive were located in the Big Lost River drainage and the Silver Creek drainage. The anadromous fish hatcheries were located in the upper Salmon River. Review of stocking records indicated fish from these fish hatcheries were released into the following major drainages of the state: Coeur d'Alene, upper and lower Salmon (including major tributaries upstream from Salmon, Idaho), South Fork Boise, Big Wood, Big Lost, Little Lost, South Fork Snake, and Teton rivers and Salmon Falls Creek. Sampling in natural populations for presence/absence was concentrated in the waters which had received releases of fish from positive fish hatcheries. Additional sampling occurred, as time and manpower permitted, in the other drainages of the state which had no known introductions of positive fish.

Statewide testing confirms MC is widespread in Idaho. Although the exact date of initial infection in the state is unknown, it has been confirmed since 1985 (Kent Hauk, Utah Department of Agriculture, personal communication). The current distribution coincides with stocking records from the four positive fish hatcheries during 1985 to 1987. I bElleve the primary vector of initial spread was the transportation and release of live fish either to private off-channel ponds (private fish hatchery source) or directly into public waters (state fish hatchery source). The subsequent spread downstream from stocking sites has occurred or is likely to occur in the future. There is no known method of eradication of the parasite once it is in a drainage. It is presently Idaho state policy that no known MC-positive fish will be released into drainages where the parasite is not nown $^{+o}$ exist. Stoc .ng policy of positive fish into positive drainages should be reviewed on a case-b' case basis. It is currently unknown whether continuing introductions of positive hatchery fish may maintain a higher threshold level of the parasite in a drainage. Managers should try to reduce and eradicate MC infections in fish hatchery and rearing sources to reduce the future transfer to state waters. This has been accomplished at the resident fish hatchery facilities in Idaho, but problems still exist at several

anadromous fish hatcheries where sacrificing of all infected fish would put the long-term viability of salmon and steelhead stocks in jeopardy.

With the presence of MC in many Idaho drainages, the next step is to quantify the impacts of the parasite on natural salmonid populations. Biologists do not understand what combination of environmental and parasite variables are required to cause an outbreak of whirling disease. Data is needed to quantify the percent of infection and spore loading of salmonids in positive drainages. Population monitoring will be conducted to examine the potential for year class failure. Fry exposure (sentinel) tests will be conducted to determine susceptibility based on drainage, species, and time of emergence (Nehring and Thompson 1996, Vincent 1996).

RECOMMENDATIONS

1. Reduce and eradicate MC infections at fish hatchery and rearing sources to reduce the future transfer of the pathogen to either negative or positive drainages.

2. Increase the number of population monitors in positive waters to evaluate year class strength and total population levels.

3. Quantify spore loading and percent of infection of salmonids in positive drainages.

4. Conduct fry exposure tests to determine susceptibility based on drainage, species, and time of emergence.

ACKNOWLEDGMENTS

Carla Hogge, Roberta Scott, and Sharon Wavra put in many long hours in the Eagle Fish Health Laboratory to complete digest and histological analysis of samples collected across Idaho. Regional fisheries management and state fisheries research personnel assisted with collecting samples for lab analysis. Jim Younk and Rod Scarpella assisted with sample collection and delivery to the lab. Kent Hauk, currently employed with Utah Department of Agriculture, provided much needed guidance during the early development of this project when I had little knowledge of MC and the sampling protocol. Fred Partridge, Alan Byrne, and Dan Schill reviewed initial drafts of this report and provided valuable comments. Rick Holm provided technical assistance on report preparation.

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APPENDIX

Appendix A. Sample locations, sample size, and lab results of statewide presence/absence sampling for *Myxobo/us cerebra/is in* Idaho from January 1, 1995 to April 10, 1996.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Panhandle Region	** Big Creek	Brook Trout	Juvenile	+	1
Panhandle Region	Big Creek	Cutthroat Trout	Wild	-	1
Panhandle Region	Coeur d'Alene Lake	Fall Chinook	Adult	-	1
Panhandle Region	N.F. Coeur d'Alene	Rainbow Trout	Wild	-	18
Panhandle Region	** N.F. Coeur d'Alene	Whitefish	Wild	+	16
Panhandle Region	** St. Joe River	Cutthroat Trout	Juvenile	+	65
Panhandle Region	Wolf Lodge Creek	Fall Chinook	Broodstock	-	35
Cabinet Gorge Hatchery	Sullivan Springs	Kokanee	Broodstock	-	60
Clark Fork Hatchery	Clark Fork River	Cutthroat Trout	Broodstock	-	60
Sandpoint Hatchery	Washoe Park	Cutthroat Trout	Broodstock	-	30
Clearwater Region	American River	Rainbow Trout	Adult	-	20
Clearwater Region	Crooked River	Chinook	Juvenile	-	19
Clearwater Region	Crooked River	Cutthroat Trout	Juvenile	-	3
Clearwater Region	Crooked River	Spring Chinook	Wild	-	34
Clearwater Region	Crooked River	Steelhead, B group	Juvenile	-	4
Clearwater Region	Crooked River	Steelhead, B group	Wild	-	1
Clearwater Region	Crooked River	Whitefish	Wild	-	2
Clearwater Region	Dworshak Reservoir	Kokanee	Adult	-	7
Clearwater Region	Fish Creek	Steelhead, B group	Juvenile	-	10
Clearwater Region	N.F. Clearwater	Rainbow Trout	Fingerling	-	2
Clearwater Region	Rapid River	Bull Trout	Juvenile	-	9
Clearwater Region	Red River	Spring Chinook	Wild	-	16
Clearwater Region	Selway River	Rainbow Trout	Adult	-	20
Clearwater Region	Walton Creek	Cutthroat Trout	Adult	-	13
Clearwater Region	White Sands Creek	Cutthroat Trout	Adult	-	2
Clearwater Region	Whitebird Creek	Rainbow Trout	Adult	-	4
Clearwater Hatchery	Clearwater Settling Pond	Chinook	Juvenile	-	3
Clearwater Hatchery	Clearwater Settling Pond	Rainbow Trout	Adult	-	19
Clearwater Hatchery	Dworshak X Selway	Steelhead, B group	Juvenile	-	45
Clearwater Hatchery	Dworshak	Steelhead, B group	Juvenile	-	60
Clearwater Hatchery	Ennis	Rainbow Trout	Fingerling	-	14

Appendix A. Continued.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Clearwater Hatchery	N.F. Clearwater	Steelhead, B group	Juvenile	-	5
Clearwater Hatchery	Selway	Steelhead, B group	Juvenile	-	50
Clearwater Hatchery	Selway River	Spring Chinook	Broodstock	-	50
Clearwater Hatchery	Selway River	Summer Chinook	Broodstock	-	18
Crooked River	Crooked River	Spring Chinook	Juvenile	-	80
Crooked River	Crooked River	Spring Chinook	Smolt	-	10
Crooked River	Crooked River	Steelhead, B group	Juvenile	-	4
Crooked River	Selway	Steelhead, B group	Juvenile	-	10
Powell Ponds	Powell	Spring Chinook	Broodstock	-	1
Powell Ponds	Powell	Spring Chinook	Juvenile	-	20
Rapid River Hatchery	Rapid River	Spring Chinook	Broodstock	-	32
Rapid River Hatchery	Rapid River	Spring Chinook	Juvenile	-	67
Red River Ponds	Red River	Spring Chinook	Broodstock	-	1
Red River Ponds	Red River	Spring Chinook	Juvenile	-	31
Southwest Region	Black Warrior Creek	Rainbow Trout	Wild	-	43
Southwest Region	Boise River	Rainbow Trout	Wild	-	61
Southwest Region	Bruneau River	Red Band Trout	Adult	-	34
Southwest Region	Deadwood Reservoir	Kokanee	Broodstock	-	60
Southwest Region	Fish Lake	Cutthroat Trout	Broodstock	-	30
Southwest Region	Golden Lake	Rainbow Trout	Adult	-	1
Southwest Region	Little Salmon River	Rainbow Trout	Wild	-	18
Southwest Region	Lucky Peak Reservoir	Kokanee	Adult	-	1
Southwest Region	Lucky Peak Reservoir	Rainbow Trout	Adult	-	2
Southwest Region	Manchester Pond, McCall	Rainbow Trout	Catchable	-	23
Southwest Region	Mountain View Reservoir	Rainbow Trout	Adult	-	1
Southwest Region	N.F. Payette River	Rainbow Trout	Wild	-	1
Southwest Region	N.F. Payette River	Whitefish	Wild	-	30
Southwest Region	Rapid River	Rainbow Trout	Wild	-	23
Southwest Region	S.F. Payette River	Rainbow Trout	Adult	-	62
Southwest Region	## S. F. Boise River	Rainbow Trout	Wild	+	60
Southwest Region	## S.F. Boise River	Whitefish	Wild	+	60
Southwest Region	Trail Creek Lakes	Cutthroat Trout	Adult	-	7
Southwest Region	Yuba River	Rainbow Trout	Juvenile	-	37

Appendix A. Continued.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Eagle Hatchery	E.F. Salmon River	Chinook	Broodstock	-	2
Eagle Hatchery	Red Fish Lake	Sockeye Salmon	Broodstock	-	51
Lab Research	Sawtooth	Steelhead, A group	Juvenile	+	22
McCall Hatchery	S.F. Salmon River	Summer Chinook	Adult	-	1
McCall Hatchery	S. F. Salmon River	Summer Chinook	Broodstock	-	66
McCall Hatchery	S.F. Salmon River	Summer Chinook	Juvenile	-	20
South Fork	South Fork	Summer Chinook	Juvenile	-	20
Magic Valley Region	Ace Development	Tilapia	Mixed	-	60
Magic Valley Region	** Big Wood River	Rainbow Trout	Juvenile	+	5
Magic Valley Region	** Big Wood River	Rainbow Trout	Wild	+	35
Magic Valley Region	** Big Wood River	Whitefish	Juvenile	-	3
Magic Valley Region	Dworshak	Steelhead, B group	Adult	-	1
Magic Valley Region	Dworshak	Steelhead, B group	Juvenile	-	20
Magic Valley Region	Loving Creek	Brown Trout	Wild	-	1
Magic Valley Region	** Loving Creek	Rainbow Trout	Wild	+	83
Magic Valley Region	Silver Creek	Brown Trout	Juvenile	-	2
Magic Valley Region	Silver Creek	Rainbow Trout	Juvenile	-	1
Magic Valley Region	Stalker Creek	Brown Trout	Juvenile	-	28
Magic Valley Region	Stalker Creek	Rainbow Trout	Juvenile	-	60
Magic Valley Region	Stalker Creek	Rainbow Trout	Wild	-	110
Magic Valley Region	** Warm Springs Creek	Rainbow Trout	Wild	+	40
Hagerman State Hatchery	Ennis	Rainbow X Cutthroat Hybrid	Catchable	-	8
Hayspur Hatchery	** Hayspur	Rainbow Trout	Broodstock	+	130
Hayspur Hatchery	** Hayspur	Rainbow Trout	Catchable	+	840
Hayspur Hatchery	Hayspur	Rainbow Trout	Fingerling	-	200
Magic Valley Hatchery	Dworshak	Steelhead, B group	Adult	-	3
Magic Valley Hatchery	Dworshak	Steelhead, B group	Juvenile	-	20
Magic Valley Hatchery	East Fork	Steelhead, B group	Juvenile	-	40
Magic Valley Hatchery	Pahsimeroi River	Steelhead, A group	Juvenile	-	40
Niagara Springs Hatchery	Hells Canyon	Steelhead, A group	Juvenile	-	40
Niagara Springs Hatchery	Pahsimeroi River	Steelhead, A group	Juvenile	-	40
Rangen Aquaculture Center	Rangen	Rainbow Trout	Fingerling	-	25

Appendix A. Continued.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Southeast Region	Bear River	Rainbow Trout	Adult	-	2
Southeast Region	Cub River	Rainbow Trout	Adult	-	1
Southeast Region	Yellowstone	Cutthroat Trout	Broodstock	-	14
American Falls Hatchery	Trout Lodge	Rainbow Trout	Juvenile	-	12
Grace Hatchery	Grace Settling Pond	Rainbow Trout	Juvenile	-	10
Grace Hatchery	Hayspur	Rainbow Trout	Catchable	-	60
Upper Snake Region	Antelope Creek	Brook Trout	Wild	-	7
Upper Snake Region	Antelope Creek	Rainbow Trout	Wild	-	1
Upper Snake Region	Big Lost River	Rainbow Trout	Wild	-	27
Upper Snake Region	## Cherry Creek	Brook Trout	Juvenile	+	30
Upper Snake Region	Cherry Creek	Rainbow Trout	Juvenile	-	1
Upper Snake Region	E.F. Big Lost River	Brook Trout	Wild	-	4
Upper Snake Region	## E.F. Big Lost River	Brook Trout	Wild	+	15
Upper Snake Region	E.F. Big Lost River	Mountain Whitefish	Wild	-	5
Upper Snake Region	## E.F. Big Lost River	Rainbow Trout	Wild	+	10
Upper Snake Region	Henrys Fork	Brook Trout	Wild	-	2
Upper Snake Region	Henrys Lake	Rainbow Trout	Wild	-	46
Upper Snake Region	## Little Lost River	Rainbow Trout	Wild	+	25
Upper Snake Region	## Mackay Reservoir	Kokanee	Wild	+	20
Upper Snake Region	## Mackay Reservoir	Rainbow Trout	Wild	+	1
Upper Snake Region	Palisades Reservoir	Fine Spot Cutthroat	Wild	-	1
Upper Snake Region	S.F. Snake River	Brown Trout	Wild	-	65
Upper Snake Region	S.F. Snake River	Cutthroat Trout	Wild	-	67
Upper Snake Region	S.F. Snake River	Mountain Whitefish	Wild	-	128
Upper Snake Region	## S.F. Snake River	Rainbow Trout	Wild	+	70
Upper Snake Region	S.F. Snake River	Rainbow X Cutthroat Hybrid	Wild	-	53
Upper Snake Region	Sawmill Creek	Brook Trout	Wild	-	1
Upper Snake Region	## Sawmill Creek	Rainbow Trout	Wild	+	40
Upper Snake Region	Snake River	Brown Trout	Adult	-	1
Upper Snake Region	Star Hope Creek	Brook Trout	Wild	-	20
Upper Snake Region	Summit Creek	Brook Trout	Wild	-	2
Upper Snake Region	Summit Creek	Rainbow Trout	Wild	-	62
Upper Snake Region	Teton River	Brook Trout	Wild	-	23

Appendix A. Continued.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Upper Snake Region	## Teton River	Cutthroat Trout	Wild	+	65
Upper Snake Region	## Teton River	Mountain Whitefish	Wild	+	65
Upper Snake Region	## Teton River	Rainbow Trout	Wild	+	48
Upper Snake Region	## Wet Creek	Rainbow Trout	Wild	+	15
Ashton Hatchery	Hayspur	Rainbow Trout	Catchable	-	20
Henrys Lake	Henrys Lake	Brook Trout	Broodstock	-	50
Henrys Lake	Henrys Lake	Cutthroat Trout	Broodstock	-	60
Henrys Lake	## Henrys Lake	Cutthroat Trout	Broodstock	+	60
Salmon Region	Big Hat Creek	Rainbow Trout	Wild	-	6
Salmon Region	Cape Horn Lake	Brook Trout	Adult	-	8
Salmon Region	Carmen Creek	Rainbow Trout	Juvenile	-	3
Salmon Region	Colson Creek	Rainbow Trout	Juvenile	-	14
Salmon Region	E.F. Salmon River	Bull Trout	Adult	-	2
Salmon Region	E.F. Salmon River	Cutthroat Trout	Adult	-	1
Salmon Region	E.F. Salmon River	Spring Chinook	Juvenile	-	15
Salmon Region	E.F. Salmon River	Spring Chinook	Wild	-	2
Salmon Region	## E.F. Salmon River	Steelhead, B group	Juvenile	+	11
Salmon Region	E.F. Salmon River	Whitefish	Wild	-	5
Salmon Region	## Hawley Creek	Rainbow Trout	Juvenile	+	16
Salmon Region	Indian Creek	Rainbow Trout	Adult	-	2
Salmon Region	## Lawson Creek	Rainbow Trout	Wild	+	7
Salmon Region	## Lemhi River	Rainbow Trout	Juvenile	+	7
Salmon Region	## Lemhi River	Whitefish	Juvenile	+	1
Salmon Region	Marsh Creek	Spring Chinook	Juvenile	-	1
Salmon Region	Rattle Snake Creek	Rainbow Trout	Adult	-	4
Salmon Region	Salmon River	Brook Trout	Wild	-	70
Salmon Region	Salmon River	Whitefish	Wild	-	1
Salmon Region	Upper Salmon River	Bull Trout	Fingerling	-	1
Salmon Region	Upper Salmon River	Steelhead, A group	Wild	-	1
Salmon Region	Warm Springs Creek	Rainbow Trout	Adult	-	6
Salmon Region	W. F. Yankee Fork River	Chinook	Juvenile	-	7
Salmon Region	W.F. Yankee Fork River	Steelhead X Rainbow	Juvenile	-	16
Salmon Region	W.F. Yankee Fork River	Whitefish	Juvenile	-	1

Appendix A. Continued.

Location	Site/Stock Information	Species	Comments	Positive/ Negative	Total Fish Sampled
Salmon Region	Yellow Belly Lake	Brook Trout	Wild	-	3
Salmon Region	Yellow Belly Lake	Cutthroat Trout	Broodstock	-	20
Mackay Hatchery	Arlee	Rainbow Trout	Catchable	-	60
Mackay Hatchery	Hayspur	Rainbow Trout	Fingerling	-	60
Mackay Hatchery	Saratoga	Brown Trout	Fingerling	-	20
Mackay Hatchery	Settling Pond	Cutthroat Trout	Feral	-	1
Mackay Hatchery	## Settling Pond	Rainbow Trout	Wild	+	2
Mackay Hatchery	Westslope	Cutthroat Trout	Fingerling	-	60
Pahsimeroi Hatchery	** Pahsimeroi River	Bull Trout	Juvenile	-	1
Pahsimeroi Hatchery	** Pahsimeroi River	Rainbow Trout	Adult	+	2
Pahsimeroi Hatchery	Pahsimeroi River	Steelhead, A group	Broodstock	-	30
Pahsimeroi Hatchery	** Pahsimeroi River	Steelhead, A group	Broodstock	+	93
Pahsimeroi Hatchery	** Pahsimeroi River	Summer Chinook	Broodstock	-	43
Pahsimeroi Hatchery	** Pahsimeroi River	Summer Chinook	Juvenile	+	30
Pahsimeroi Hatchery	Yellow Belly Lake	Cutthroat Trout			14
Sawtooth Hatchery	East Fork	Spring Chinook	Wild	-	2
Sawtooth Hatchery	** East Fork	Steelhead, B group	Broodstock	+	12
Sawtooth Hatchery	E.F. Salmon River	Spring Chinook	Juvenile	-	20
Sawtooth Hatchery	E.F. Salmon River	Steelhead, A group	Broodstock	-	18
Sawtooth Hatchery	## Lemhi River	Spring Chinook	Broodstock	-	2
Sawtooth Hatchery	## Lemhi River	Spring Chinook	Wild	+	2
Sawtooth Hatchery	## S. F. East Fork	Spring Chinook	Juvenile	+	1
Sawtooth Hatchery	Sawtooth	Spring Chinook	Broodstock	-	14
Sawtooth Hatchery	Sawtooth	Spring Chinook	Juvenile	-	78
Sawtooth Hatchery	** Sawtooth	Steelhead, A group	Broodstock	+	95
Sawtooth Hatchery	** Sawtooth	Steelhead, A group	Juvenile	+	148
Sawtooth Hatchery	Slate Creek	Steelhead, B group	Broodstock	-	11
Sawtooth Hatchery	W.F. Yankee Fork River	Spring Chinook	Broodstock	-	2
Sawtooth Hatchery	W.F. Yankee Fork River	Spring Chinook	Wild	-	1
Oxbow, Oregon	Hells Canyon	Steelhead, A group	Broodstock	-	59

New 1995-1996 confirmed whirling disease site.
** Previously confirmed whirling disease site.

ANNUAL PERFORMANCE REPORT

State of: Idaho

Grant: F-73-R-18. Fishery Research

Project No.: 3

Title: Wild Trout Investigations

Subproject No.: 2. Evaluations of Salmonid Restricted Harvest Regulations Permitting the Use of Bait

Period covered: April 1. 1995 to March 31, 1996

ABSTRACT

The Idaho Department of Fish and Game first used restricted harvest regulations without banning the use of bait beginning in 1984 on the South Fork Snake River. Since then, numerous additional waters have been managed with this type of regulation. There has been no formal evaluation of the use of bait in conjunction with restricted harvest regulations in Idaho. This study is the first year of a three-year effort to evaluate the fish population and sport fishing changes since restricted harvest regulations permitting bait were enacted on the Big Wood River and Silver Creek.

Within the restricted harvest section of the Big Wood River, separate sections exist for catch-and-release (no bait) and the slot limit (two fish bag limit, none between 304 mm to 406 mm, bait allowed). During 1995 in the Big Wood River, section 4 (catch-and-release) had the highest density of wild rainbow trout of the sections sampled. Sections 2 and 3 (slot limit regulation) had higher densities than the upstream catch-and-release sections (6 and 6A). Catch-and-release sections (4, 6, and 6A) had quality stock density (QSD) values for wild rainbow trout near 10, compared to slot limit sections (2 and 3) with QSD values of about 5. During 1995, following 5 years of restricted harvest (catch-and-release or slot limits) the densities in sections 2, 3, and 4 were higher, compared to the period 1986-1988 (prior to restricted harvest).

In Silver Creek the catch-and-release section (Stalker Creek) had higher densities of rainbow trout *Oncorhynchus mykiss* and brown trout Salmo *trutta* compared to the slot limit, bait allowed section (Martin Bridge). However, the Stalker Creek populations were dominated by age 0 and age 1 + trout and, therefore, had a QSD of 3.3, compared to the slot limit section with a QSD of 10.3.

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INTRODUCTION

Historically, Idaho has been one of the national leaders in wild trout management, beginning with restricted harvest as a management tool in the 1960s. Early regulations included size and bag restrictions and later catch-and-release (Mallet 1963, Ortmann 1969, Ball 1971). In the first hooking mortality study, Westerman (1932) indicated bait hooking losses of about 10%, while Shetter and Allison (1955) and Hunsaker et al. (1970) reported bait-associated mortality exceeding 50%. Wydoski's (1977) summary of over 50 studies indicated average mortality equaled nearly 25%. These elevated hooking mortalities associated with bait, compared to artificial lures and flies, has represented unacceptable losses of angler-released fish to Idaho fisheries managers. Based on these studies, a ban on using bait has typically accompanied restricted harvest regulations due to increased hooking mortality associated with bait-caught fish (Mongillo 1984).

However, more recent studies suggest that bait restrictions may not always be necessary in special regulation fisheries. Carline et al. (1990) reported creation of a successful catch-and-release fishery for brown trout in central Pennsylvania without restricting bait. On the Housatonic River in Connecticut, a bait allowed catch-and-release regulation for hatchery rainbow trout resulted in higher biomass, despite higher angler effort (Bob Orciari, Connecticut Department Environmental Protection, personal communication). Schill (1992) observed that bait-hooking in flowing waters may be substantially lower that average values from the literature and that, depending on management goals, quality trout angling and bait fishing may be compatible.

Bait fishing is extremely popular in Idaho; it was the preferred gear of 37% of anglers surveyed in 1987 (Reid 1989). A bait restriction has recently been challenged in court (Thurow and Schill 19941, perhaps because of the large number of stream miles where bait anglers are already excluded in Idaho. A management challenge exists to manage for wild trout, which usually requires some form of harvest restrictions while not excluding bait anglers from all quality trout waters.

Idaho first implemented restricted harvest with bait-allowed during 1984 on a cutthroat trout *Oncorhynchus clarki* fishery in the South Fork Snake River. The idea behind including bait anglers was to gain higher public support for a new harvest restriction and provide an opportunity for all anglers to participate. Moore and Schill (1984) modeled this fishery and found that the population recovery would be somewhat slower with the inclusion of bait, but would meet management goals even with additional hooking mortality. The success of this initial bait-allowed regulation (Elle et al. 1987) led to the expansion of the use of bait in additional restricted harvest fisheries in Idaho (Henrys Fork Snake River-1992, Big Wood River-1990, Silver Creek-1992, St. Joe River-1994).

Despite the initial report of Elle et al., no formal evaluation of bait-allowed regulation limits has been conducted in Idaho. The expansion of bait-allowed restricted harvest regulations has raised some management questions: 1) how effective have the regulations been at improving fish populations?; 2) how has the angler profile and use changed?; and 3) do bait anglers take advantage of the opportunity to fish these waters when they are required to release a portion of the fish they catch? Formal evaluations of the response of the fishery and the angler use of these waters is needed to provide Idaho biologists with information upon which to make future management decisions regarding the use of bait in restricted harvest

fisheries. This is the first year of a three-year study to evaluate the fishery and angler use of three streams in southern Idaho managed with restricted harvest regulations permitting the use of bait.

OBJECTIVES

Research Goal: Determine if quality wild trout angling and the use of bait are compatible.

1. Evaluate population responses to restricted harvest regulations with bait allowed.

2. Quantify angler use and satisfaction in fisheries following implementation of restricted harvest regulations with bait allowed.

STUDY AREAS

The study areas are described in detail in prior studies: Big Wood River (Thurow 1990) and Silver Creek (Riehle et al. 1989). In the Big Wood River, I selected sample sections 2 and 3, 4, 6, and 6A from Thurow's original sites. Sections 6 and 6A have been managed as catch-and-release since 1976. Section 4 was changed from general regulations to catch-and-release (no bait) and sections 2 and 3 were changed from general regulations to a two fish limit, none between 304 mm to 406 mm (12 in to 16 in) (bait allowed) in 1990.

In Silver Creek, I selected the Stalker Creek and Martin Bridge sections. Stalker Creek has been managed as catch-and-release (fly fishing only) since 1977 (Riehle et al.1989). Martin Bridge was changed from general regulations to a two fish limit slot limit, none between 304 mm to 406 mm (12 in to 16 in) (bait-allowed) in 1990.

METHODS

Fish Population Estimates,

During 1995, we conducted populations estimates on five sections the Big Wood River for comparison to results from 1986 to 1988 sampling (Thurow 1990). We also duplicated population estimates on two sections of Silver Creek for comparison to pre-regulation years (Riehle et al. 1989).

I attempted to capture all species and sizes of trout and mountain whitefish *Prosopium williamsoni* using electrofishing gear. I conducted population estimates using Peterson mark-recapture methods. Marking runs generally consisted of a single downstream pass through a sample section. I using a Honda 5,000 W generator as the power source and rectified the AC current into straight DC current using a Coffelt VVP-15. Recapture runs were completed one to two weeks following marking runs. In the Silver Creek Martin Bridge section, I completed

two passes for the marking and recapture runs. In Silver Creek, three individuals floated in an aluminum drift boat with two fixed anodes to collect fish. In the Big Wood River, a five to six person wading crew collected fish using two hand-held anodes. An aluminum canoe served as the cathode and also transported the electrofishing gear. Samples of nongame fish were collected for species identification and size range.

In Silver Creek, I completed marking and recapture runs on the Stalker section on August 29 and September 6, respectively, and on the Martin Bridge section on August 30 and September 7, respectively. In the Big Wood River, I completed marking and recapture runs as follows: Section 2 (Halley) marked September 28, recaptured October 12; Section 3 (Starweather) marked September 26, recaptured October 10; Section 4 (Gimlet) marked September 25, recaptured October 11; and Sections 6 and 6A (Lake Creek and Highway) marked September 27, recaptured October 13.

Stunned fish were netted and held in plastic garbage cans. Every 100 m to 300 m, fish were worked up and released. I anesthetized fish with MS-222 and collected species, length, and weight information. I recorded the total length to the nearest millimeter of all salmonids captured and subsampled weights (nearest 2 g) from up to 10 fish per 10 mm length group. I inspected fish for external signs of whirling disease including black tail, scoliosis, and concave cranial deformities. I applied a mark to the caudal fin of all fish 100 mm or larger using a paper punch. Following recovery, fish were distributed back upstream within the sample section. Section lengths and widths (recorded every 50 m) were used to calculate surface area (Table 1) to determine density (fish/km and fish/ha) estimates for comparison between years.

Table 1. Sample section dimensions for the Big Wood River and Silver Creek for fish population sample sights during October 1995.

River / Section	Section Length (m)	Mean Width (m)	Surface Area (ha)
Big Wood River			
Hailey (site 2)	1,858	19.95	3.71
Starweather (site 3)	1,002	20.91	2.10
Gimlet (site 4)	1,455	19.75	2.87
Lake Creek (site 6)	1,208	15.68	1.89
Hiway Channel (site 6A)	964	15.71	1.51
Silver Creek			
Lower Stalker	1,050	9.30	0.98
Martin Bridge-Point of Rocks	2,500	25.00	6.25

Fish data were entered and analyzed using the computer program MARKRECAPTURE 4.0 (MDFWP 1994). The program generated population estimates based on log likelihood and modified Peterson methods. I used the log likelihood estimates if efficiency curves were acceptable based on Chi-square analysis performed by the software. When low numbers of recaptures precluded the use of log likelihood, I used modified Peterson estimates and combined data for various length groups. I calculated population estimates and 95% confidence intervals by 100 mm length groups (recaptures permitting) and summed for estimates of fish larger than 200 mm. Quality stock densities (QSD) were estimated as:

$$QSD = \frac{F_1}{F_2} * 100$$

where F_1 = number of fish > 400 mm and F_2 = number of fish > 200 mm.

RESULTS

Fish Population Estimates

During 1995, the Big Wood River supported densities of wild rainbow from 85 to 317 fish/ha (Tables 2 and 3). The Gimlet section (catch-and-release) had the highest density of wild rainbow trout of all the sections sampled. In the Hailey and Starweather sections, managed with the slot limit, densities were greater than in the two upstream catch-and-release sections (6 and 6A). The latter sections are in a river section with steeper gradient and less volume. The catch-and-release sections had quality stock density (QSD) values for wild rainbow trout near 10, compared to slot limit sections with QSD values of about 5 (Table 3). Mountain whitefish made up less than 10% of our catch and reliable estimates were not possible. The estimate for hatchery rainbow trout equaled 236 in the Hailey section.

In Silver Creek, the catch-and-release section (Stalker Creek) had higher densities of rainbow trout and brown trout, compared to the slot limit section (Martin Bridge) (Table 4). However, the Stalker Creek populations were dominated by age 1 + trout and, therefore, had a QSD much lower than the slot limit section. Martin Bridge had a QSD of 10.3, approximately equal to the catch-and-release sections of the Big Wood River. The Martin Bridge section had fewer age 1 + and almost no age 0 fish in comparison with Stalker Creek.

DISCUSSION

This is the first of three sample seasons to evaluate the Big Wood River regulations. Silver Creek will be repeated at least one more season. Therefore, conclusions are preliminary and discussion is purposely limited.

Table 2. Wild rainbow trout population estimates with 95% confidence intervals for sample sections in the Big Wood River during October 1995.

Reach / Size (mm)	Number Marked	Recapture Run: Number Caught	Recapture Run: Number Recaptured	Population Estimate	±95% C.I.
Hailey (site 2)					
100-199	347	368	55	2,716	570
200-299	227	167	45	720	116
300-399	39	35	15	95	25
400-499	10	10	5	27	84
All (z 200)	276	212	65	842	--
Starweather (site 3)					
100-199	231	176	44	1,064	265
200-299	78	46	12	206	41
300-399	44	33	10	210°	112*
400-499	2	10	1		--
All (z 200)	124	89	23	416	
Gimlet (site 4)					
100-199	267	276	50	1,869	392
200-299	132	156	43	414	63
300-399	136	176	57	388	63
400-499	28	33	13	107	37
All (z 200)	296	365	113	909	
Lake reek (site 6)					
100-199	97	121	25	458	131
200-299	34	15	5	92	49
300-399	19	13	5	45	22
400-499	6	6	1	23	20
All (z 200)	59	34	11	160	
Highway Channel (site 6A)					
100-199	158	129	36	598	155
200-299	41	33	9	101	25
300-399	23	24	5	161*	143
400-499					
All (2200)	64	z7	14	262	

* Combined estimate for fish 300 mm to 499 mm, due to lack of recaptures.

Table 3. Fish population estimates, densities (fish/km and fish/ha) and quality stock densities (QSD) for wild rainbow trout sampled in the Big Wood River in October 1995.

A

Section	Section No.	Regulation	$\hat{N}^{*}$	Fish/km	Fish/ha	QSD
Hailey	2	Slot	842	453	227	4.1
Starweather	3	Slot	416	416	198	5.6
Gimlet	4	C&R [b]	909	623	317	9.2
Lake Creek	6	C&R	160	132	85	12.9
Highway Channel	6A	C&R	262	273	174	10.1
Stalker Creek	-	Slot	481	458	490	3.3
Martin Bridge to Point of Rocks	-	C&R	751	300	120	10.3

[a] $\hat{N}^{*}$ = the population estimate for trout 2200 mm total length.

[b] C&R = catch-and-release.

Table 4. Population estimates and 95% confidence intervals for wild rainbow trout and brown trout in Lower Stalker Creek and Silver Creek (Martin Bridge to Point of Rocks) during September 1995.

Reach / Size (mm)	Species	Number Marked	Recapture Run - Number Caught	Recapture Run - Number Recaptured	Population Estimate	±95% C.I.
Stalker Creek						
100-199	Rbt [a]	191	346	57	1,148	269
200-299[b]		57	125	15	481	229
300-399		--	--	--	--	--
≥400		--	--	--	--	--
All (≥200)		57	125	15	481	
100-199	Brn [c]	583	162	28	3,394	1144
200-299 [b]		50	67	14	239	112
300-399		--	--	--	--	--
≥400		--	--	--	--	--
All (≥ 200)		50	67	14	239	
Martin Bridge-Point of Rocks						
100-199	Rbt	54	326	3	636	341
200-299		91	76	16	425	164
300-399[d]		106	49	16	326	129
≥400		--	--	--	--	--
All (≥200)		197	125	32	751	
100-199	Brn	37	21	0	N.E.	--
200-299[e]		16	17	2	101	--
300-399		19	20	10	39	--
≥400		49	44	17	124	--
All (≥200)		84	81	27	264	

[a] Rbt = rainbow trout.
[b] Includes all fish z 200 mm.
[c] Brn = brown trout.
[d] Includes all fish z 300 mm.
[e] Modified Peterson population estimate.

During 1995, following five years of restricted harvest (catch-and-release or slot limits) the densities in sections 2, 3, and 4 were higher, compared to the period 1986-1988, prior to restricted harvest (Table 5). In our control area (section 6) densities were similar over the entire study period. It appears that numbers in both the slot limit (section 2 and 3) and catch-and-release (section 4) areas have increased after restricted harvest regulations were implemented.

The QSD in the slot limit sections (with limited harvest and bait allowed) is only half the value of the catch-and-release areas. The lower QSD values in the slot limit areas may result from angler harvest of legal sized fish >406 mm.

Table 5. Estimated wild rainbow trout (2200 mm) populations and densities during fall sampling in the Big Wood River. Data from 1986-1988 is from Thurow (1990). Data from 1991-1993 is from Partridge and Warren (1995).

Site	Year	Population Estimate	95% C.I.	Trout/100 m	Trout/100 m^2
2	1987	583	338-1,093	29.2	1.89
	1992	974	834-1,114	48.7	3.31
	1995	842	723- 961	45.3	2.27
3	1986	81	42- 171	7.6	0.37
	1987	220	128- 413	20.6	1.23
	1993	329	221- 437	30.7	0.92
	1995	416	296- 536	41.6	1.98
4	1986	455	258- 878	23.0	1.33
	1987	301	187- 512	15.2	1.00
	1992 [a]	895	713-1,077	79.9	4.06
	1993	1001	770-1,232	64.2	3.26
	1995	909	812-1,006	62.3	3.17
6	1986	168	107- 277	14.6	0.97
	1987	161	97- 285	14.0	0.95
	1990[b]	199	141- 289	12.1	0.86
	1992	209	171- 243	18.2	1.29
	1993	213	141- 285	17.3	1.18
	1995	168	108- 228	13.2	0.85
6A	1992	113	85- 141	11.6	0.77
	1993	269	174- 364	**25.2**	1.74
	1995	262	116- 408	27.3	1.74

[a] Section length reduced due to low river flows. [b]

[b] Includes portion of old highway river site.
Section length estimated to be 1.65 km and area of 2.32 ha.

Thurow (1990) concluded productivity in the Big Wood River could support a limited harvest, including associated bait hooking mortality, and still maintain a self-sustaining wild trout fishery. The positive population response in the bait-allowed slot limit areas supports Thurow's conclusion. Several factors may contribute to this positive response. Bait hooking mortality in streams is probably not as high as reported by Mongillo (1984) and Wydoski (1977). Schill (1992) estimated bait hooking mortality of 17% in an Idaho stream and suggests average values from past studies could be misleading because these summaries include studies conducted in still-water ponds, lakes, and raceways where the incidence of deep-hooking (and presumably hooking losses) is higher than for streams. Hyatt et al. (1996) concluded bait hooking mortality for hatchery rainbow trout on the Farmington River could not have exceeded 10% because the population would be zero by the end of the summer had mortality been 25% and 50%.

Another reason for higher densities of fish in 1995 could be displacement of bait anglers from these sections of the Big Wood River. Angler effort increased in restricted harvest sections in 1993, compared to the period 1986 to 1988 (Partridge and Warren 1995). However, the percentage of anglers using bait decreased in 1993. A full-scale creel census should be completed in 1997 for further comparison with pre-regulation data.

QSD's provided useful comparison between sections in the Big Wood River but not in Silver Creek. I bElleve habitat changes between sections which favor juvenile fish will skew QSD values. QSD's should be used in conjunction with density information to describe and compare populations.

RECOMMENDATIONS

1. Conduct two more years of population estimates in the Big Wood River. Conduct at least one more year of population estimates on Silver Creek.

2. Cooperate with Upper Snake Region to conduct a stratified creel census in 1996 on the South Fork Snake River to evaluate changes in effort, gear types, and angler attitudes.

3. Conduct a stratified creel census on Big Wood River in 1997 for comparison with 1986-1988.

ACKNOWLEDGMENTS

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ANNUAL PERFORMANCE REPORT

State of: Idaho Project No.: Grant: F-73-R-18, Fishery Research

Title: Bull Trout Investigations

Subproject No.: 1. Rapid River Bull Trout Movement and Mortality Studies

Period covered: April 1, 1995 to March 31. 1996

ABSTRACT

Rapid River adult bull trout *Salvelinus confluentus* counts equaled 224 fish in 1995, a 50% increase from 1994 and 1993. The percentage of fish larger than 500 mm equaled 13.8% in 1995, compared to 5.5% in 1994, 8.7% in 1993 and 12.5% in 1992. The increase in observed numbers and size of bull trout are within the range observed in past years.

Survival of 1994 spawners to the upstream trap in 1995 equaled 33%. Estimated survival during spawning in 1995 ranged from 67% to 82%, compared to 35% in 1992 and 46% to 55% in 1993.

Downstream trap data from 1995 confirms 1994 results indicating a large portion of 300 mm to 400 mm bull trout captured during September and October are not part of the upstream migration and are leaving the drainage for the first time. The presence of these fish in the fall downstream migration accounts for the difference in survival observed in 1993 between untagged and radio-tagged bull trout. I conclude their is no difference in survival during spawning between radio-tagged and untagged bull trout, based on 1994 and 1995 data. Therefore, surgically-implanted radio tags can be used as a monitoring tool for adult bull trout.

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INTRODUCTION

Bull trout *Salvelinus confluentus* were petitioned for listing under the Endangered Species Act in 1992. In 1994, the Idaho Fish and Game Commission closed bull trout harvest statewide, except in the Pend Oreille drainage, out of concern for the status of population numbers. The Idaho Department of Fish and Game (IDFG) has been collecting life history data on fluvial bull trout stocks since 1992 in an effort to better understand the behavior and biology of the species and to document response to the regulation changes.

IDFG maintains several upstream traps to collect adult chinook salmon *Oncorhynchus tshawytscha* for hatchery propagation. These facilities also allow IDFG to monitoring fluvial bull trout populations. Information from the Rapid River chinook salmon trap provides one of the best trend data sets for fluvial bull trout in Idaho. Continued data collected at Rapid River provides information for IDFG to evaluate the life history of fluvial bull trout populations and the effects of harvest closure on these populations.

Radio telemetry of Rapid River bull trout has greatly added to our knowledge of fluvial bull trout migration, spawning, and overwinter life history. However, results from 1992 (Schill et al. 1994) raised concerns that radio tags surgically placed in the body cavity of adult bull trout could result in high mortality of tagged fish. Results from 1994 suggested the mortality of radio-tagged versus untagged bull trout was very similar, but incomplete trapping of post-spawning fish compromised the data (Elle 1995). During 1995, we operated a downstream weir for a third season to document the spawning survival of untagged bull trout (z 300 mm) in Rapid River. We also utilized the downstream trap to tag bull trout with Passive-Integrated-Transponder (PIT) tags for future survival and growth data.

OBJECTIVES

Research Goal: Provide sufficient life history data to maintain and restore bull trout for trophy fishing opportunities.

1. To estimate the spawning mortality of bull trout in Rapid River.

2. To monitor bull trout population response (survival, numbers and size of individuals) in response to "no harvest" regulations imposed in 1994.

STUDY AREA

Rapid River is a fourth-order tributary to the Little Salmon River near Riggins, Idaho. The study area is described in detail in Schill et al. (1994).

METHODS

Adult Migration,

Rapid River Fish Hatchery personnel maintain a velocity barrier weir to collect adult chinook salmon for spawning from Rapid River. During 1995, these facilities were used to collect and enumerate adult bull trout during their upstream migration. Hatchery personnel recorded numbers of bull trout entering the upstream trap daily. Fish were anesthetized with MS-222 and measured to the nearest millimeter (total length). Each fish was scanned for the presence of PIT tags implanted in downstream migrating bull trout during fall 1993 and 1994. Each fish was inspected for the presence of radio or floy tags applied during the previous three years. A scale sample was collected from all fish with an individual tag identification. All fish were examined for the presence of adipose fin clips administered during 1994. The end of the right maxillary bone was clipped to later identify fish for 1995 post-spawning survival estimates. Following data collection, fish recovered in fresh water for 15 min to 30 min and were released upstream of the fish trap.

Downstream Traooing

A picket-style weir at Rapid River Fish Hatchery was used to collect downstream migrant salmonids. The design and dimensions are described in Elle et al. (1994). The trap was placed in Rapid River on July 26 and operated through October 26, when high water breached the weir.

Biological data was recorded for all fish collected in the downstream trap. Fish were anesthetized using MS-222, identified, measured to the nearest millimeter (total length for bull trout and fork length for steelhead *Oncorhynchus mykiss,* and weighed to the nearest gram. All downstream migrants 300 mm were examined for evidence of adipose or maxillary clips administered at the upstream trap during 1994 and 1995, respectively. Bull trout ≥300 mm that did not have maxillary clips were considered either fish that bypassed the upstream trap through the sediment bypass pipe at the adult trap or fish on their first downstream migration from Rapid River. All outmigrant bull trout were injected with PIT tags. We used 20 mm PIT tags in 1995, versus the 12 mm tags used in the past. The larger tags will provide a greater likelihood of detection for future identification of individual fish. Survival and growth of PIT-tagged fish will be assessed by hatchery personnel interrogating all bull trout with PIT tag detectors in future Rapid River adult runs.

Age Validation

We injected a sample of bull trout with oxytetracycline (OTC) to mark otoliths for future validation of age estimates (Beamish and McFarlane 1987). OTC was injected into the intramuscular area of the fish, anterior to the pelvic girdle. The rate of application was 50 mg OTC per kilogram of fish. All fish were held in live cars for 24 h following tagging to assess

short-term mortality associated with PIT and OTC tagging, after which they were released downstream of the trap.

RESULTS

Adult Migration

A total of 224 bull trout were captured during the 1995 spawning migration. This is a 53% increase over the numbers in 1993 and 1994, but lies within the range trapped since 1973 (Figure 1). Bull trout were captured from May 8 through September 7 (Figure 2). Most fish entered the trap by July 20.

Size of bull trout captured during upstream migration ranged from 330 mm to 565 mm during 1995 (Figure 2). Fish 2500 mm equaled 13.8% of the total trapped during 1995. This reverses the downward trend in the percentage of fish 500 mm from 1992 through 1994 (Table 1).

During 1994, 146 upstream-migrant bull trout were adipose fin-clipped. In 1995, we captured 48 upstream-migrant bull trout with adipose fin clips for a calculated survival or 32.9% during the one-year interval.

From 1992 to 1995, the project obtained data from 48 bull trout with tags (radio, floy, or PIT) which could be used to individually identify the fish after known periods of time. Growth declined with size. Growth averaged 0.327 mm per day for fish which were marked as juveniles <300 mm (Table 2). Fish marked at 300 mm to 399 mm averaged 0.226 mm per day; fish marked at ≥400 mm averaged 0.146 mm per day growth between captures.

Based on time between captures, only one repeat spawner spent more than 12 months in the Salmon River between captures. This represents the only alternate-year spawning bull trout found during the Rapid River study. All other documented repeat spawners have been consecutive-year spawners.

Downstream Trapping

We captured 414 bull trout between August 14 and October 26, 1995. Two hundred sixteen were juveniles (<300 mm) with 198 adults and sub-adults (≥300 mm). All juvenile and untagged adults were PIT-tagged (Appendix A).

I estimate the spawning survival of adult and sub-adult bull trout within Rapid River was a minimum of 63.7% (142 of 224 upstream migrants) during 1995. During 1992 and 1993, 30% of radio-tagged bull trout <450 mm outmigrated from Rapid River prior to spawning, typically in June and early July. By applying 30% to the 105 upstream migrants <450 mm during 1995, I estimate 32 of the 224 upstream migrant may have migrated downstream prior to installation of the downstream trap. This would provide an upper survival estimate of 74%.

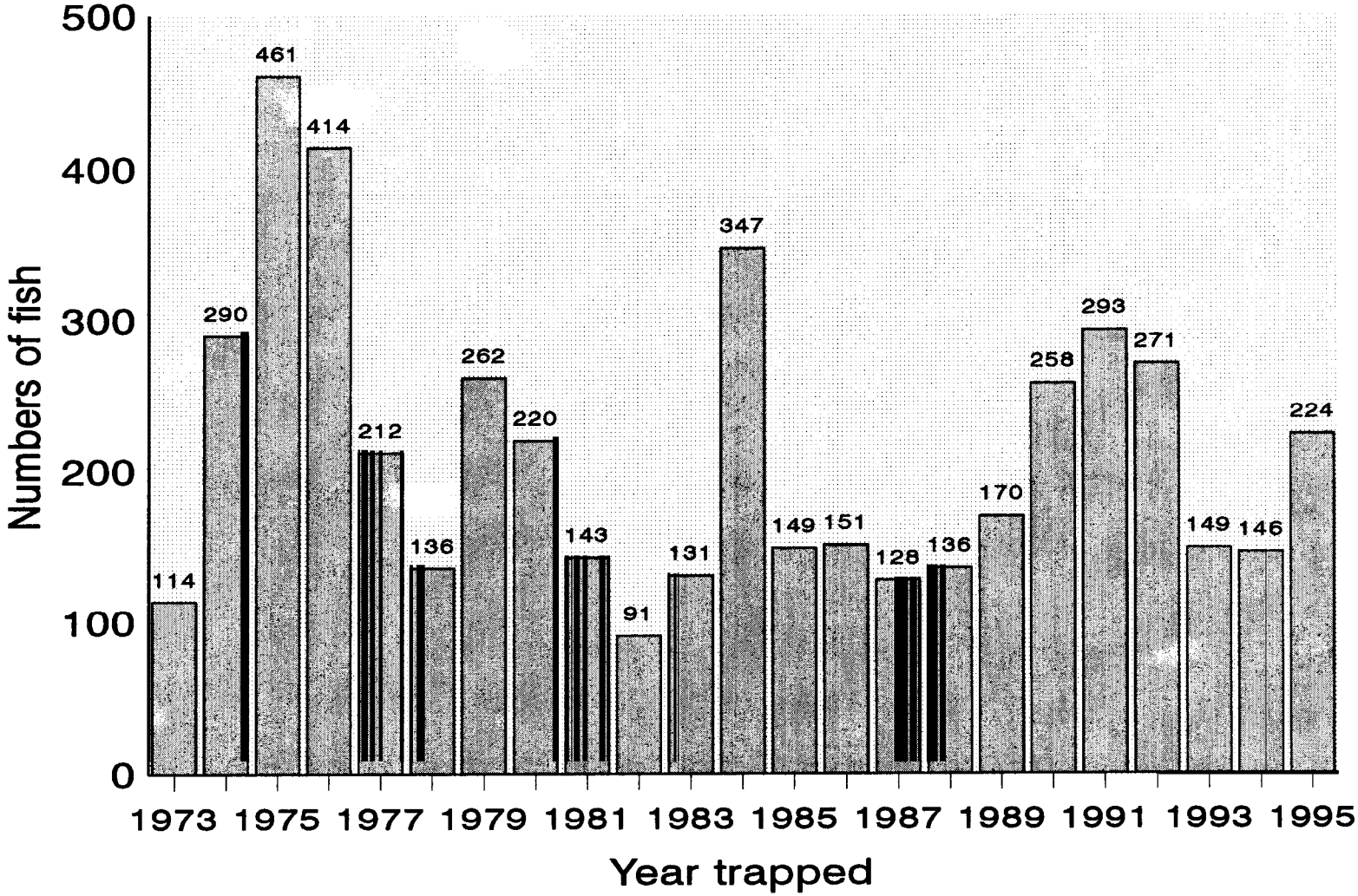

Figure 1. Numbers of adult bull trout moving upstream past the Rapid River weir, 1973-1994.

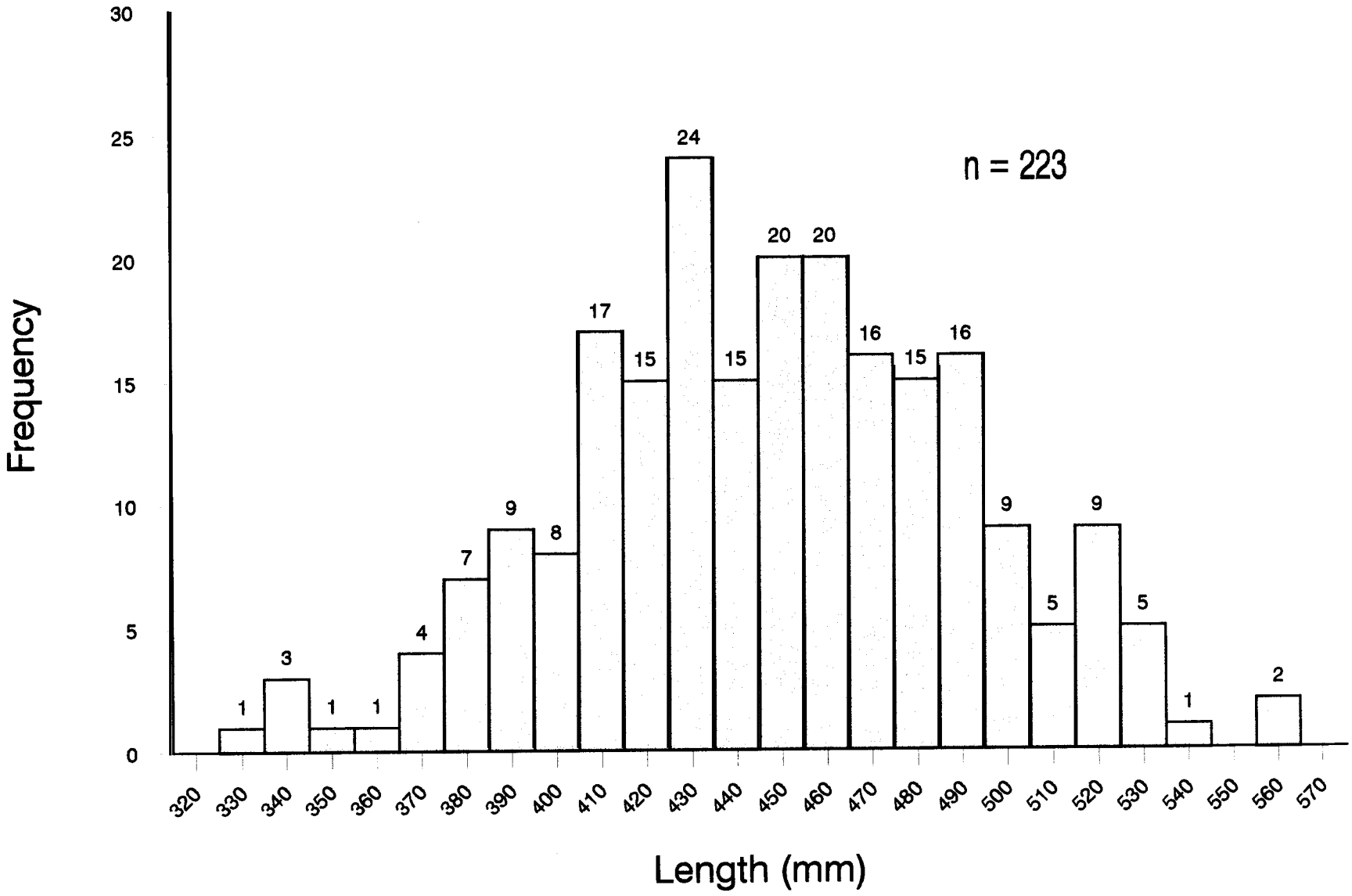

Figure 2. Length-frequency of bull trout captured at the Rapid River upstream weir, 1995.

Table 1. Mean total length (mm) and percent of run 500 mm for upstream-migrant bull trout in Rapid River, 1992 through 1995.

Year	Number of fish	Length of fish	
		Mean	% ≥ 500mm
1992	267	412	12.2
1993	147	411	7.5
1994	146	421	5.5
1995	223	454	13.8

Table 2. Growth of bull trout (mm per day between captures) captured two or more times from 1992 through 1995 at Rapid River.

Fish size at tagging	Sample size	Growth (mm)	
		Mean	Range
<300 mm	15	0.317	0.227-0.400
301-400 mm	11	0.226	0.151-0.366
≥401 mm	22	0.146	0.044-0.274

A second adult survival estimate was calculated using only the adipose fin-clipped 1995 upstream migrants (the adipose clip was used as the 1994 upstream mark). The estimated survival for adipose fin-clipped fish was *75%* for all fish and 82% with an adjustment for early drop out of fish <450 mm.

Only 69% of the bull trout 2300 mm captured at the downstream trap did not have maxillary fin clips indicating they were upstream migrants from the Salmon River (Table 3). The percentage of maxillary-clipped fish ranged from 0% of the fish from 300 mm to 350 mm to 100% of fish >500 mm. The data is consistent with results from 1994 when 57% of a subsample of 35 outmigrants 2300 mm were marked during upstream migration. These results indicate a large portion of bull trout from 300 mm to 400 mm captured at the downstream trap were first time outmigrants and were not part of the upstream migration.

Age Validation

Two hundred forty-one bull trout were injected with OTC for future age validation studies. These fish were also PIT-tagged. We only had one mortality of an OTC-injected bull trout. This fish may have died from PIT tagging or from the OTC dose and injection.

Table 3. Summary of marked versus unmarked outmigrant bull trout 300 mm captured in the downstream migration trap in Rapid River during 1994 and 1995.

Size group (mm)	Number marked			Number unmarked			Percentage of unmarked fish
	1994	1995	Total	1994	1995	Total	
300-350	1	1	2	9	23	32	94%
351-400	4	9	13	2	24	26	67%
401-450	8	47	55	3	6	9	14%
451-500	6	50	56	1	5	6	11%
>501	1	32	33	0	0	0	0%
Totals	20	139	159	15	58	73	31%

DISCUSSION

The Idaho Fish and Game Commission closed bull trout to harvest in Idaho (except the Lake Pend Oreille and the lower Clark Fork River) on January 1, 1994. The total numbers and percent of bull trout 500 mm captured at the Rapid River chinook trap during 1995 increased, compared to 1993 and 1994 (Elle et al. 1994, Elle 1995). The number of fish trapped in 1995 was well within the range of 91-461 observed from 1973 to 1994 and the percent of fish ≥500 mm was similar to 1992 (Elle 1995). Harvest restrictions have resulted in increases in bull trout populations beginning in the second year following restrictions in Lake Kananaskis in Alberta, Canada (Stelfox and Egan 1995), the Flathead River in Montana (Fraley and Shepard 1989), and the Metolius River in Oregon (Amy Stuart, Oregon Department of Fish and Wildlife, personal communication). Continued bull trout monitoring in Rapid River will document whether the 1995 data represent a positive population response to harvest restrictions following no-harvest regulations.

The downstream trap data for 1995 confirms 1994 results indicating a large portion of fall bull trout outmigrants >300 mm are not part of the upstream migration monitored at the salmon trap. During 1995, 31% of the downstream migrant bull trout >300 mm were not marked. This compares to 43% during 1994, when downstream trapping was incomplete due to a breach in the weir (Elle 1995). During 1995, only one of the fish had an adipose fin clip (1994 adult mark), but not a right maxillary clip (1995 adult mark). Thus, I did not observe a large number of fish > 300 mm which could have escaped detection at the upstream trap facilities.

During 1993, I observed a significant difference in the survival between radio-tagged versus untagged bull trout, but suspected the difference was an artifact of having a portion of fish in the outmigration which were not handled in the upstream migration (Elle et al. 1994). The 1995 data supports the conclusion that the difference observed in survival between radio-

tagged versus untagged bull trout (Elle et al. 1994) was due to the presence of new, unmarked fish in the non-tagged group during outmigration versus upstream trapping. Thus, the reduced survival of radio-tagged fish I originally reported (Elle et al. 1994) is not real, and bull trout can be radio-tagged without increases in spawning mortality.

Survival estimates for bull trout during spawning in 1995 range from 64% to 82%. Survival during 1995 was higher, compared to data from 1992 to 1994 when survival estimates ranged from 35% to 55%. During 1995, we experienced a higher water year with a later spring runoff. Bull trout were later in entering the adult trap facilities. Higher flows with a shorter staging period for spawning in Rapid River may have resulted in the higher survival rate during 1995.

RECOMMENDATIONS

1. Continue monitoring Rapid River and other salmon trapping facilities to monitor bull trout numbers and size to provide evaluation of the bull trout no-harvest regulation.

2. The use of surgically implanted radio tags does not increase spawning mortality in adult bull trout. This technology can be safely used to gain valuable life history data on migratory bull trout populations.

3. Hatchery personnel should continue to monitor Rapid River adult bull trout for PIT tag information to collect data on survival and repeat spawning fish and for collection of OTC-marked fish.

ACKNOWLEDGMENTS

Michele Baer supervised collection of data during adult trapping and PIT tag monitoring at the Rapid River adult trapping facility. Rick Lowell and the rest of the Rapid River Fish Hatchery staff assisted with monitoring upstream migration and during busy periods of downstream trapping operations. Jim Younk and Brian Leth maintained the downstream trap and completed tagging work. Jim Younk and Rod Scarpella completed much of the PIT tagging data entry and summary. Rod Scarpella oversaw the OTC injection study. Fred Partridge, Alan Byrne, and Dan Schill reviewed initial drafts of this report and provided valuable comments. Rick Holm provided technical assistance on report preparation.

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A P P E N D I X

Appendix A. PIT tag data files for bull trout captured at Rapid River, fall 1995.

Date	PIT tag number	Length	Weight	Scale sample number	Comments
07/26/95	7F7BOB4F6E	204	66	95-28	
07/26/95	7F7B054024	273	165	95-27	
07/26/95	7F7BOB3B4D	307	225	95-26	
07/26/95	7F7B0B5770	311	235	95-24	
07/26/95	7F7B0B4B66	291	190	95-25	
07/26/95	7F7B0B475D	289	210	95-23	
07/26/95	7F7B0B573A	237	118	95-22	
08/12/95	7F7B0B525E	200	70	95-29	
08/12/95	7F7B0B5007	190	48	95-30	
08/12/95	7F7B08674C	480		95-31	
08/14/95	7F7B0B6313	175	42	95-32	
08/14/95	7F7B0B4D76	195	60	95-33	
08/14/95	7F7B0B5B12	207	68	95-34	
08/15/95	7F7B0B5912	195	57	95-35	
08/16/95	7F7B0B5172	171	36	95-36	
08/18/95	7F7BOB5B12				RC
08/19/95	7F7B0B5803	197	64	95-37	
08/19/95	7F7BOB4E3F	210	80	95-38	
08/19/95	7F78042471	192	64	95-39	
08/19/95	7F7B0B630D	196	66	95-40	
08/19/95	7F7B053F61	235	116	95-41	
08/21/95	7F7B0B3907	214	74	95-42	
08/23/95	7F7B053E7B	179	58	95-43	
08/23/95	7F7BOB5A4C	202	89	95-44	
08/23/95	7F7B053F54	240	150	95-45	
08/23/95	7F7B053F54	182	66	95-46	
08/23/95	7F7B0B521A	192	75	95-47	
08/23/95	7F7B053F3B	184	69	95-48	
08/24/95	7F7B053F3B				RC
08/25/95	7F7B042678	203	94	95-49	
08/29/95	7F7D567025	340	370	95-50	
08/30/95	7F7B053F31	196	58	95-51	
08/30/95	7F7B053F61				RC
08/30/95	7F780B613E	216	84	95-52	
08/30/95	7F7B041208	214	80	95-53	
09/08/95	7F7B03045D	238	150	95-54	
09/09/95	7F7D7A515B	204	56	95-55	
09/10/95	7F7B04126D	222	92	95-56	
09/10/95	7F7B0B390E	210	78	95-57	
09/10/95	7F7BOB5AOF	210	70	95-58	
09/10/95	7F7B0B402A	227	102	95-59	
09/11/95	7F7B041861	216	78	95-61	
09/11/95	7F7B0B387F	226	90	95-62	
09/11/95	7F7B042651	501	1005	95-62	AD RM
09/12/95	7F7D4F5216	450	565	95-63	AD RM
09/12/95	7F7B0B3803	514	1050	95-64	RM
09/12/95	7F7B0B5960	236	114	95-65	

Appendix A. Continued.

Date	PIT tag number	Length	Weigh	Scale sample number	Comments
09/12/95	7F7B053F30	215	74	95-66	
09/12/95	7F7B04113C	198	63	95-67	
09/12/95	7F7BOB6208	205	73	95-68	
09/12/95	7F7BOB4D77	182	50	95-69	
09/14/95	7F7BOA6F09	183	56	95-70	AD RE
09/15/95	7F7BOB513D	495	915	95-71	RM
09/16/95	7F7B041252	217	86	95-72	OTC RC-TC
09/17/95	7F7B053F5F	489	880	95-73	OTC AD RM
09/17/95	7F7B041436	440	640	95-74	OTC AD RM
09/18/95	7F7BOB3942	181	46	95-75	OTC
09/18/95	7F7BOB5028	191	54	95-76	OTC
09/18/95	7F7BOB4F6D	291	190	95-77	OTC
09/18/95	7F7BOB502F	366	330	95-78	OTC RM
09/18/95	7F7B041 E38	429	620	95-79	OTC RM
09/18/95	7F7BOB4D51	456	740	95-80	OTC AD
09/18/95	7F7BOB507C	473	730	95-81	OTC AD RM
09/18/95	7F7BOB5662	473	845	95-82	OTC
09/18/95	7F7BOB5124	458	714	95-83	OTC RM
09/19/95	7F7BOB5027	345	352	95-84	OTC
09/20/95	7F7B041 D25	324	245	95-85	OTC
09/20/95	7F7BOB4F7E	411	560	95-86	OTC RM
09/20/95	7F7BOB3951	196	96	95-87	OTC
09/20/95	7F7B053E76	199	66	95-88	OTC
09/21/95	7F7BOB4E40	172	44	95-89	OTC
09/21/95	7F7BOB613D	157	32	95-90	OTC
09/21/95	7F7BOB6242	499	1005	95-91	OTC RM
09/21/95	7F7BOB583B	441	610	95-92	OTC RM
09/21/95	7F7B054001	437	605	95-93	OTC RM
09/21/95	7F7BOB5715	479	865	95-94	OTC AD RM
09/21/95	7F7BOB511E	501	905	95-95	OTC RM
09/21/95	7F7BOB5760	482	850	95-96	OTC RM
09/21/95	7F7BOB5736	476	770	95-97	OTC RM
09/21/95	7F7BOB5C71	452	600	95-98	OTC AD RM
09/22/95	7F7B041 FOB	215	98	95-94A	OTC
09/22/95	7F7B05404A	205	68	95-95A	OTC
09/22/95	7F7BOB3878	208	74	95-96A	OTC
09/22/95	7F7BOB565F	211	84	95-97A	OTC
09/22/95	7F7B042261	197	62	95-98A	OTC
09/22/95	7F7BOB5442	212	80	95-99	OTC
09/22/95	7F7BOB5A43	252	116	95-100	OTC
09/22/95	7F7BOB575F	203	64	95-101	OTC
09/22/95	7F7BOB5D23	221	66	95-102	OTC
09/22/95	7F7B04177D	213	80	95-103	OTC
09/22/95	7F7BOB4E31	191	56	95-104	OTC
09/22/95	7F7BOB364E	235	94	95-105	OTC
09/22/95	7F7B042421	226	96	95-106	OTC
09/22/95	7F7BOB516C	236	102	95-107	OTC

Appendix A. Continued.

Date	PIT tag number	length	Weight	Scale sample number	Comments
09/22/95	7F7B04177C	223	90	95-108	OTC RC-TC
09/22/95	7F7B042575	259	126	95-109	OTC
09/22/95	7F7BOB5149	183	48	95-110	OTC
09/22/95	7F7BOB4756	21 1	80	95-111	OTC
09/22/95	7F7BOB402D	351	285	95-112	OTC
09/22/95	7F7B042147	340	330	95-113	OTC RC-TC
09/22/95	7F7BOB6138	330	233	95-114	OTC
09/22/95	7F7BOB5C39	433	560	95-115	OTC RM AD
09/22/95	7F7BOB573E	373	350	95-1 16	OTC
09/22/95	7F7D7F5B5E	440	600	95-117	OTC RE RM
09/22/95	7F7BOB5A2A	342	240	95-118	OTC
09/22/95	7F7BOB5463	411	495	95-119	OTC RM
09/22/95	7F7B041633	408	450	95-120	OTC RM
09/22/95	7F7BOB5304	425	510	95-121	OTC RM
09/22/95	7F7BOB612F	350	290	95-122	OTC RM
09/22/95	7F7B05404F	452	645	95-123	OTC RM
09/22/95	7F7BOB5D5A	450	665	95-124	OTC RM
09/22/95	7F7BOB5F2A	405	510	95-126	OTC RM
09/22/95	7F7BOB566A	411	550	95-127	OTC RM
09/22/95	7F7BOB4E3D	435	565	95-128	OTC RM
09/22/95	7F7BOB514D	410	465	95-129	OTC RM
09/22/95	7F7BOB4101	460	620	95-130	OTC RM AD RC-TC
09/22/95	7F7B041 D58	540	1090	95-131	OTC RM
09/22/95	7F7B042374	364	360	95-132	OTC
09/22/95	7F7BOB3742	480	820	95-133	OTC
09/22/95	7F7BOB3B17	484	985	95-134	OTC RM
09/22/95	7F7BOB6028	544	1050	95-135	OTC RM
09/22/95	7F7BOB4E05	477	840	95-136	OTC RM
09/22/95	Radio Tag	572		95-137	RM
09/23/95	7F7BOB5129	186	48	95-138	
09/23/95	7F7BOB4C41	208	80	95-139	
09/23/95	7F7B041 F41	195	64	95-140	
09/23/95	7F7B053F2C	182	56	95-141	
09/23/95	7F7B041207	225	86	95-142	
09/23/95	7F78041202	215	74	95-143	
09/23/95	7F7BOB4778	216	74	95-144	
09/23/95	7F7BOB4D29	207	72	95-145	
09/23/95	7F7BOB5B77	210	74	95-146	
09/23/95	7F7BOB4D75	220	80	95-147	
09/23/95	7F7BOB570C	205	64	95-148	
09/23/95	7F7BOB5C64	216	76	95-149	
09/23/95	7F7B053F7C	206	66	95-150	
09/23/95	7F7BOB3B14	223	86	95-151	
09/23/95	7F78042060	213	71	95-152	
09/23/95	7F7B041320	220	80	95-153	
09/23/95	7F7BOB5303	194	56	95-154	
09/23/95	7F7B04160F	209	70	95-155	

Appendix A. Continued.

Date	PIT tag number	Length	Weight	Scale sample number	Comments
09/23/95	7F7BOB5D3E	206	64	95-156	
09/23/95	7F7B0B5118	227	86	95-157	
09/23/95	7F7B04165C	230	88	95-158	
09/23/95	7F7BOB405B	236	106	95-159	
09/23/95	7F7B04131 B	199	54	95-160	
09/23/95	7F7B054029	206	66	95-161	
09/23/95	7F7B054014	411	535	95-162	RM
09/23/95	7F7BOB5D5D	451	590	95-163	AD RM
09/23/95	7F7BOB5334	506	950	95-164	RM
09/23/95	7F7B041 F06	435	630	95-165	RM
09/23/95	7F7BOB4B65	455	650	95-166	AD RM
09/23/95	7F7BOB4029	428	540	95-167	RM
09/23/95	7F7B053F77	490	790	95-168	RM AD
09/23/95	7F7BOB5A38	442	580	95-169	RM
09/23/95	7F7BOB5C69	475	680	95-170	RM
09/23/95	7F7BOB6070	446	685	95-171	
09/23/95	7F7BOB6240	422	530	95-172	RM
09/23/95	7F7B042711	434	750	95-173	RM
09/23/95	7F7BOB4C46	338	275	95-174	
09/23/95	7F7B041924	466	710	95-175	RM
09/23/95	7F7B05401 C	439	590	95-176	RM
09/23/95	7F7BOB512D	406	457	95-177	RM
09/23/95	7F7BOB5D41	365	405	95-178	RC-TC
09/23/95	7F7BOB391 A	503	955	95-179	RM AD
09/23/95	7F7B054000	471	735	95-180	RM
09/23/95	7F7BOB6243	430	590	95-181	RM
09/23/95	7F7B04237F	492	885	95-182	RM
09/23/95	7F7B053F59	465	790	95-183	RM AD
09/23/95	7F7BOB5B15	522	1105	95-184	RM
09/23/95	7F7B053FOC	438	570	95-185	RM AD
09/23/95	7F7B053F76	549	1250	95-186	AD RM
09/23/95	7F7B053F02	382	410	95-187	RM
09/23/95	7F7BOB5204	489	990	95-188	RM
09/23/95	7F7BOB3A13	402	525	95-189	RM
09/23/95	7F7B054004	509	935	95-190	RM AD
09/23/95	7F7BOB5229	462	690	95-191	RM AD
09/23/95	7F7BOB522A	466	820	95-192	RM
09/23/95	7F7B0B403E	512	1070	95-193	RM AD
09/24/95	7F7BOB7004	237	111	95-194	OTC RC-TC
09/24/95	7F7BOB5236	204	70	95-195	OTC
09/24/95	7F7BOB3CIF	345	285	95-196	OTC
09/24/95	7F7B04165D	440	690	95-197	OTC RM
09/24/95	7F 7B041 F68	485	870	95-198	OTC RM
09/24/95	7F7B054136	360	290	95-199	OTC
09/24/95	7F7BOB4E16	432	645	95-200	OTC RM
09/24/95	7F7B05401 B	532	1130	95-201	OTC RM
09/25/95	7F7B041860	242	106	95-202	

Appendix A. Continued.

Date	PIT tag number	Length	Weight	sample number	Comments
09/25/95	7F7BOB4F32	228	94	95-203	
09/25/95	7F7BOB577C	207	69	95-204	
09/25/95	7F7BOB5445	189	48	95-205	RC-TC
09/25/95	7F7B053F50	176	40	95-206	RC-TC
09/25/95	7F7B041 D37	476	770	95-207	RM
09/25/95	7F7D445933	442	695	95-208	RE
09/25/95	7F7BOB523F	394	440	95-209	RM
09/25/95	7F7B04182A	358	343	95-210	RM
09/26/95	7F7BOB514A	223	88	95-211	OTC
09/27/95	7F7D7A4526	379	430	95-212	OTC
09/27/95	7F7B00592F	199	[7]4	95-213	OTC RC-TC
09/27/95	7F7B036567	229	96	95-214	OTC RC-TC
09/28/95	7F7D7D7860	189	60	95-215	OTC
09/29/95	7F7D7C6E31	507	970	95-216	OTC RM
09/30/95	7F7D782254	197	64	95-217	OTC
09/30/95	7F7D7D4723	556	1400	95-218	RM AD
09/30/95	7F7BOC6B72	431	590	95-219	OTC
10/01/95	7F7D7D430C	205	68	95-220	OTC
10/01/95	7F7B053F32	216	76	95-221	OTC
10/01/95	7F7D7A5C20	215	70	95-222	OTC
10/01/95	7F7B00641 D	236	100	95-223	OTC
10/01/95	7F7B037373	196	57	95-224	OTC
10/01/95	7F7B05373F	195	56	95-225	OTC
10/01/95	7F7D7A5154	226	82	95-226	OTC
10/01/95	7F7B03321 B	229	98	95-227	OTC
10/01/95	7F7BOB5816	216	70	95-228	OTC
10/01/95	7F7B027F78	230	84	95-229	OTC
10/01/95	7F7D772201	535	1205	95-231	RM AD
10/01/95	7F7BOC690E	487	860	95-230	RM
10/01/95	7F7BOB1202	548	1240	95-232	RM AD
10/01/95	7F7B04210A	501	825	95-233	RM AD
10/01/95	7F7D7A4260	488	918	95-234	RM
10/01/95	7F7D7131 B03	464	762	95-235	
10/01/95	7F7BOB545E	440	630	95-236	RM
10/01/95	7F7D7A240C	442	590	95-237	RM
10/01/95	7F7BOB5E64	412	550	95-238	AD RM
10/01/95	7F7D56642D	385	430	95-240	OTC RM
10/01/95	7F7B030351	367	348	95-239	OTC
10/01/95	7F7DOE7154	385	408	95-241	OTC
10/01/95	7F7BOC6C3F	356	310	95-242	OTC
10/01/95	7F7D7C7007	396	440	95-243	OTC RM
10/01/95	7F7D771674	342	260	95-244	OTC
10/01/95	7F7BOB5D29	340	308	95-245	OTC
10/02/95	7F[7]0513500	206	88	95-246	OTC RC-TC
10/02/95	7F"303181 C	230	92	95-248	OTC
10/02/95	7F 3053F08	230	100	95-247	OTC
10/02/95	7F7BOC3958	326	225	95-249	OTC RC-TC

Appendix A. Continued.

Date	PIT tag number	Lengt	Weight	Scale sample number	Comments
10/02/95	7F7BOB2F58	195	58	95-250	OTC
10/02/95	7F7B03307B	271	155	95-251	OTC
10/02/95	7F7B04202D	345	255	95-252	OTC
10/02/95	7F7D7D1 D10	456	720	95-253	OTC RM
10/02/95	7F7BOB2A24	461	775	95-254	OTC RM AD
10/03/95	7F7D7D6B24	226	76	95-255	
10/03/95	7F7D7A5A03	209	72	95-256	
10/03/95	7F7D7D2229	199	62	95-257	RC-TC
10/03/95	7F7BOB3046	201	60	95-258	
10/03/95	7F7B03174D	384	400	95-259	
10/03/95	7F7B040520	267	150	95-260	OTC
10/03/95	7F7B0B5C 14	251	126	95-261	OTC
10/03/95	7F7BOB3908	210	68	95-262	OTC
10/03/95	7F7B027E61	214	77	95-263	OTC RC-TC
10/03/95	7F7D790D65	286	185	95-264	OTC
10/03/95	7F7D7D5774	329	270	95-265	OTC
10/03/95	7F7BOB517B	374	350	95-266	OTC
10/03/95	7F7D7A4E3A	371	365	95-267	OTC
10/03/95	7F7D7D6075	403	480	95-268	OTC
10/03/95	7F7BOC6846	384	390	95-269	OTC RM
10/03/95	7F7BOB6025	370	335	95-270	OTC
10/03/95	7F7B102730	514	965	95-271	OTC AD RM RE
10/03/95	7F7BOC3C5F	467	755	95-272	OTC AD RM
10/03/95	7F7D781 D09	454	745	95-273	OTC RM
10/03/95	7F7B0C676E	472	760	95-274	OTC RM
10/03/95	7F7B057752	466	835	95-275	OTC RM
10/03/95	7F7B040426	429	605	95-276	OTC RM
10/03/95	7F7D572D26	468	730	95-277	OTC RM
10/03/95	7F7B005247	464	805	95-278	OTC RM
10/03/95	7F7B02771 D	446	670	95-279	OTC RM
10/03/95	7F7D7C523C	455	780	95-280	OTC
10/03/95	7F7BOB333E	492	920	95-281	OTC RM
10/03/95	7F7D770071	434	595	95-282	OTC RM
10/03/95	7F7B031376	496	900	95-283	OTC RM
10/03/95	7F7BOC6056	511	940	95-284	OTC RM
10/03/95	7F7B02764A	415	515	95-285	OTC RM
10/03/95	7F7D772511	438	745	95-286	OTC RM
10/03/95	7F7D7D3862	284	185	95-287	OTC
10/03/95	7F7BOBOE06	275	160	95-288	OTC
10/03/95	7F7B037605	244	113	95-289	OTC
10/03/95	7F7D771E3B	246	115	95-290	OTC
10/03/95	7F7B027206	422	515	95-291	OTC
10/03/95	7F7B030871	335	240	95-292	OTC
10/03/95	7F7B027E79	349	285	95-293	OTC
10/03/95	7F7BOB5A4C	204	66	95-294	OTC RE
10/04/95	7F7D7D5448	302	225	95-295	OTC
10/04/95	7F7BOC393F	352	395	95-296	OTC

Appendix A. Continued.

Date	PIT tag number	Length	Weight	Scale sample number	Comments
10/04/95	7F7D771133	229	105	95-297	OTC
10/04/95	7F7D7D774F	217	88	95-298	OTC
10/04/95	7F7D7D567C	186	65	95-299	OTC
10/04/95	7F7B041841	205	80	95-300	OTC
10/04/95	7F7D7A364D	203	79	95-301	OTC
10/04/95	7F7D7B256E	209	76	95-302	OTC
10/04/95	7F7D56421 F	182	54	95-303	OTC
10/04/95	7F7D7D6F45	186	52	95-304	OTC
10/04/95	7F7D7D 1920	161	36	95-305	OTC
10/04/95	7F7B03060B	219	130	95-306	OTC RC-TC
10/04/95	7F7D7D3F30	221	135	95-307	OTC
10/04/95	7F7BOB1851	441	840	95-308	OTC RM
10/05/95	7F 7D 7A4F55	174	60	95-309	OTC
10/05/95	7F7B03066E	226	130	95-310	OTC
10/05/95	7F7BOC 155E	191	84	95-311	OTC
10/05/95	7F7BOC495F	167	56	95-312	OTC
10/05/95	7F7BOC6A2F	194	82	95-313	OTC
10/05/95	7F7D7A4B2F	178	60	95-314	OTC
10/06/95	7F7B12030A	287	280	95-315	OTC
10/06/95	7F7D7A6329	198	96	95-316	OTC RC-TC
10/06/95	7F7D7D370E	221	110	95-317	OTC
10/06/95	7F7D7D2F4F	184	72	95-318	OTC RC-TC
10/06/95	7F7D78163E	236	165	95-319	OTC
10/06/95	7F7D7A382F	223	104	95-320	OTC
10/06/95	7F7B036E14	194	82	95-321	OTC
10/06/95	7F7D7C6D00	252	180	95-322	OTC
10/06/95	7F7D7D5731	211	110	95-323	OTC
10/07/95	7F7D7D2767	217	118	95-324	OTC RC-TC
10/07/95	7F7B03686B	206	90	95-325	OTC
10/07/95	7F7D772473	243	155	95-326	OTC
10/07/95	7F7B03003E	226	150	95-327	OTC
10/07/95	222D04224A	186	82	95-328	OTC AD RE
10/07/95	7F7B03000C	204	84	95-329	OTC RC-TC
10/07/95	7F7B037060	207	105	95-330	OTC
10/08/95	7F7B0C 1248	210	106	95-331	OTC
10/08/95	7F7D78130A	214	106	95-332	OTC
10/08/95	7F7B037231	182	66	95-333	OTC
10/09/95	7F7B030B69	213	112	95-334	OTC
10/09/95	7F7B05674F	161	46	95-335	OTC
10/10/95	7F7D563732	214	120	95-336	OTC RC-TC
10/10/95	7F7BOB1379	195	80	95-337	OTC RC-TC
10/10/95	7F7D7D3D06	196	82	95-338	OTC
10/10/95	7F7D7D4A4D	163	52	95-339	OTC
10/10/95	7F7B037F20	252	165	95-340	OTC
10/10/95	7F7D7C6318	253	170	95-341	OTC
10/10/95	7F7BOC345B	201	100	95-342	OTC
10/10/95	7F7D7D4545	223	118	95-343	OTC RC-TC
10/10/95	7F7D7D2234	220	112	95-344	OTC

Appendix A. Continued.

Date	PIT tag number	Length	Weight	Scale sample number	Comments
10/10/95	7F7D564837	227	130	95-345	OTC
10/10/95	7F7B037658	276	230	95-346	OTC
10/10/95	7F7D7D661D	216	108	95-347	OTC
10/10/95	7F7BOB525E	220	122	95-348	OTC RE
10/10/95	7F7BOB1143	211	102	95-349	OTC
10/10/95	7F7B030471	199	84	95-350	OTC
10/10/95	7F7B036536	211	108	95-351	OTC
10/10/95	7F7D776B66	324	380	95-352	OTC RC-TC
10/10/95	7F7B036B1 D	332	335	95-353	OTC
10/10/95	7F7D775C77	327	355	95-354	OTC
10/10/95	7F7BOC4537	369	450	95-355	OTC RC-TC
10/10/95	7F7B031746	345	335	95-356	OTC
10/10/95	7F7D766C40	389	550	95-357	OTC
10/10/95	7F7B031 D4A	362	505	95-358	OTC
10/10/95	7F7D7C6A2A	383	570	95-359	OTC
10/10/95	7F7B032E62	378	485	95-360	OTC
10/10/95	7F7B040163	420	705	95-361	OTC
10/10/95	7F7B041008	389	555	95-362	OTC RC-TC
10/11/95	7F7BOB327E	482	1195	95-363	OTC RM
10/11/95	7F7D784122	451	845	95-364	OTC RM
10/11/95	7F7B03352A	434	820	95-365	OTC RM RC-TC
10/11/95	7F7D7B256D	514	1530	95-366	LM
10/11/95	7F7D7A5E6C	456	925	95-367	OTC RM
10/11/95	7F7D7A5B14	471	1070	95-368	OTC RM AD
10/11/95	7F7D7D7448	519	1535	95-369	RM
10/11/95	7F7D7C4C30	531	1575	95-370	
10/12/95	7F7D4F5D44	215	78	95-371	RC-TC
10/12/95	7F7BOB1 C3B	248	108	95-372	
10/12/95	7F7BOB1C4C	238	100	95-373	RC-TC
10/12/95	7F7D572F5E	205	66	95-374	
10/12/95	7F7D781A7D	255	140	95-375	
10/12/95	7F7B030453	252	143	95-376	
10/12/95	7F7BOC642E	178	42	95-377	RC-TC
10/12/95	7F7D7F6B66	506	1060	95-378	RM RE
10/12/95	Radio Tag	534		95-379	
10/12/95	7F7D7A5037	542	1195	95-380	RM AD
10/12/95	7F7BOC424A	517	1050	95-381	RM
10/12/95	7F7B03077E	510	1010	95-382	RM AD
10/12/95	7F7B005D76	464	724	95-383	
10/12/95	7F7D7A1 C1 D	428	690	95-384	RM
10/12/95	7F7B03617A	443	568	95-385	RM AD
10/12/95	7F7B030E4F	373	408	95-386	RM
10/12/95	7F7D7D1972	352	380	95-387	
10/12/95	7F7B033904	398	450	95-388	RM
10/12/95	7F7BOB2376	361	343	95-389	RM
10/13/95	7F7D441 A38	206	64	95-390	RE
10/13/95	7F7B03771 D	303	210	95-391	
10/13/95	7F7D7A1 D3E	228	92	95-392	

Appendix A. Continued.

Date	PIT tag number	Length	Weight	Scale sample number	Comments
10/13/95	7F7D7D3D76	188	49	95-393	
10/13/95	7F7B032F65	495	945	95-394	RM
10/13/95	7F7D7D7661	548	1315	95-395	RM
10/13/95	7F7D7D751E	507	1060	95-396	RM AD
10/13/95	7F7D4F422B	482	895	95-397	RM AD
10/13/95	7F7D77224C	506	1015	95-398	
10/13/95	7F7B036834	545	1165	95-399	RM AD
10/13/95	7F7D572334	475	806	95-400	RM
10/13/95	7F7D573121	473	795	95-401	RM
10/13/95	7F7B036935	422	480	95-402	RM AD
10/13/95	7F7B0E6170	413	530	95-403	RE RM
10/13/95	7F7B032F4A	476	775	95-404	RM
10/13/95	7F7BC ' F74	440	630	95-405	RM
10/13/95	7F7Br. [p]357	415	520	95-406	RM
10/13/95	7F7DT ?36B	351	340	95-407	
10/13/95	7F71Y' 465	347	285	95-408	RC-TC
10/13/95	7F7D 4E57	361	285	95-409	
10/13/95	7F7D 72359	308	225	95-410	
10/13/95	7F7D7D603C	275	160	95-411	RC-TC
10/17/95	7F7D782F51	206	70	95-412	OTC
10/17/95	7F7B04055C	181	45	95-413	OTC
10/18/95	7F7D7D6C30	544	1260	95-414	RM
10/18/95	7F7B03054E	496	845	95-415	OTC RM
10/18/95	7F7B031346	459	690	95-416	OTC RM
10/18/95	7F7803193F	434	590	95-417	OTC RM
10/18/95	7F7B03686A	337	280	95-418	OTC
10/18/95	7F7B027229	212	80	95-419	OTC
10/18/95	7F7D7C6D39	272	170	95-420	OTC
10/18/95	7F7BOC166E	259	150	95-421	OTC
10/18/95	7F7D7A5F64	215	82	95-422	OTC
10/18/95	7F7B03641 B	232	100	95-423	OTC
10/18/95	7F7D7D6F65	151	29	95-424	OTC
10/20/95	7F7D7D387F	211	76	95-425	OTC
10/20/95	7F7B027B36	204	70	95-426	OTC
10/26/95	7F7BOC6A07	221	88	95-427	OTC
10/26/95	7F7D771E2A	186	52	95-428	OTC
10/26/95	7F7D7A5A3C	197	58	95-429	OTC
10/26/95	7F7B02782A	181	42	95-430	OTC
10/26/95	7F7D7D502F	200	66	95-431	OTC BRK HYB
10/26/95	7F7D3EOD1F	372	350	95-432	OTC RE
10/26/95	7F7BOC473E	527	1210	95-433	OTC RM
[1]0/29/95	7F7BOC6477	177	45	95-434	
09/29/95	7F7D7D247C	210	70	95-435	
11/01/95	7F7B03:: "23	227	89	95-436	
11/01/95	7F7B024C57	198	62	95-437	
11/01/95	7F7D771815	185	54	95-438	
11/01/95	7F7B00540D	339	285	95-439	

Submitted by:

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Senior Fishery Research Biologist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Virgil K. Moore
Chief, Bureau of Fisheries

Daniel J. Schill
Acting Fisheries Research Manager

Funds Expended:

State:	$ 27,114
Federal:	81,343
Total:	$ 108,457